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California Forest Experiment Station

UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

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Advisory Council

April 16, 1928

MEETING OF THE ADVISORY COUNCIL

OF THE

CALIFORNIA FOREST EXPERIMENT STATION

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April 16, 1928.

PROGRAM OF THE CALIFORNIA FOREST EXPERIMENT STATION

Earlier Forest Research

Research work in forestry by the United States Forest Service began with the establishment of the national forests. The character of the early work was chiefly one of fact finding - surveys and investigations designed to answer the immediately pressing problems confronting the federal forestry organization. Other agencies in this State have from time to time during the past two decades carried on research work. The State Forestry Bureau conducted numerous studies, particularly in the field of wood utilization. The Forestry School of the University of California, since its creation, has consistently required some research on the part of its teaching staff, and has contributed particularly valuable data on varied problems of the Redwood region and on the use and management of range lands.

A large part of the results of the research by the organizations mentioned has been published and applied in practice.

National Forest Experiment Stations

The need for more exact knowledge based on careful research has become apparent as the industrial uses of

our forest resources have expanded and as the administration of our national forests has been intensified. Empirical methods still must play an important part in the attack upon many of the complex problems facing us, but ultimate solutions must depend on sound basic research.

The agricultural experiment stations have been influential in making agriculture a scientific undertaking. It was natural then to adopt the same plan of organization for research in forestry that has been so eminently successful in the general field of agriculture. The plan for forest experiment stations, embodied in the organic act now before Congress provides for twelve such stations to cover all the important forest regions of the United States. A number of these stations have already been established, being located as a rule at the important agricultural colleges of the region. This is particularly advantageous in schools supporting a forestry division. The forest experiment stations are placed in a separate research branch of the United States Forest Service to relieve the personnel of routine administrative demands, which European experience has shown to be so distracting.

The California Forest Experiment Station was established two years ago, with an initial Federal appropriation of $30,000 for its support. The local administrative

organization of the Forest Service contributed about $3,000, and other agencies about $25,000 per year in addition. The small personnel employed by the administrative organization on research and the program of work already under way were taken over by the Station. In two years the permanent technical staff has been increased from three to nine and the clerical force from one to four. The main headquarters of the Station are located at the University of California. A series of substations are to be located in the principal forest regions of the State. Three of these have already been started, one in the Feather River region, one in the optimum sugar pine belt of the Stanislaus Forest, and one at Devil Canyon, near San Bernardino. These substations are the field laboratories where experimental work under natural forest conditions can be conducted.

Present Program

We believe that our major efforts should logically be directed towards the understanding and solution of the major problem of the sound use of forest land. The Station is engaged at present in six major lines of investigation, all more or less inter-related and fundamentally concerned with this problem.

The six major groups of work in the order of emphasis in last year's program are -

1. Silvicultural investigations in the pine region (Management of pine lands for timber production).
2. Forest influence studies in southern California.
3. Studies in forest products and utilization.
4. Protection - fire, insects.
5. Economic studies.
6. Reforestation.

Several of these projects were already under way before the creation of the Station, and valuable work would be lost unless they are continued over a long period of years. The increased staff has made possible the initiation of other studies, but not on a scale commensurate with their importance. For example, fire, the most serious single handicap to any secure forestry undertaking, received last year but 10 per cent of the Station's efforts. Again, economic studies, fundamental to the development of any sound forest policy, were relegated to a minor position. Just how far shifts in the program can be made with present funds is a question not to be easily answered, but it is safe to say that as added funds become available, increased efforts must be placed upon studies of fire, economics, and forest influences.

1. Silvicultural Investigations.

Silvicultural investigations have had a predominant position in the program and so far have been entirely confined to the pine region. The more important studies carried on under this major group will be briefly described.

a. Methods of Cutting. A series of detailed studies dealing primarily with the methods of cutting mature timber on national forest timber sales have been carried on for many years. Their purpose is to determine the methods of harvest that will result in the highest ultimate yield, the effects of different logging methods on the forest, and the safest and most effective means of slash disposal. In the conduct of these studies permanent sample plots, representing typical conditions, are established just before cutting. The original stand of mature timber, young growth and secondary vegetation is accurately listed; the trees to be cut and those to be left are measured and described; the original young growth is tallied and the amount of growth surviving logging is determined. The plots are examined every 5 years or oftener, and the results are analyzed. Altogether 111 plots have been selected, some of which have been under observation since 1910. They include close to 35,000 large trees, whose individual history has been

carefully followed. Similar plots should be established in all of the important types and sites, representing varying methods of timber cropping both on private and government land. From these studies we hope to secure data on growth rate of the important timber species for different site conditions, the rate of mortality from various causes through a timber rotation, the net growth of the residual stands, the relative monetary returns for given stands of timber cut in different ways, progress of restocking on cut-over areas, the best type of seed trees and the frequency of seed crops and the effects of cutting on the composition of the future stands through the intrusion of undesirable species.

The data so far secured have been the basis for the formulation of Forest Service timber sale policies now in effect. When industrial forestry becomes an actuality in California, these data can be of material assistance to the private timber holder as well.

b. Natural Regeneration. Another series of studies deals with the determination of the factors controlling natural regeneration on our forest areas. Our studies indicate strongly that in the pine region of California, the new forest will largely be dependent upon successful natural regeneration. But the conditions under which advance reproduction is established are not well known,

and the methods of cutting which will insure adequate new growth are largely undetermined.

c. Thinnings. In Europe and in some parts of the United States second growth forests are profitably thinned. At present such practice is not possible on a commercial scale in the west. Thinning studies involve long periods of time to produce conclusive results. They are the key to the proper understanding of spacing of trees at different ages and on varying sites and the production of maximum volume and quality of desired timber. A beginning must be made now to provide information when needed. Twenty-two permanent sample plots in Douglas fir, western yellow pine, sugar pine - white fir, and white fir stands have been treated to different degrees of thinning. The earliest thinning plot was made in 1912 and the latest in 1927. This work need not be greatly amplified.

d. Growth and Yield Data. The handling of forest land on a permanent cropping basis, whether by private or governmental agencies, depends upon adequate information on the growth and yields that may be expected at a given rotation for different timber types and sites. No sound cutting budget can be established without these data. To build up this information, 655 temporary and about 25 permanent plots have been studied. From these, yield tables have already been prepared for western yellow pine, under optimum growing conditions on the west slope, and on the east side of the Sierras. In cooperation with the Uni-

versity of California, yield tables are in the course of preparation for pure white fir, red fir, and Douglas fir stands.

These studies of yield have been carried on in even-aged stands. Our forests, however, where present commercial cutting is being carried on, are not homogeneous as to age. It is quite important to determine what future yields may be expected under different methods of cutting in an all-aged forest, and for this purpose a series of studies has been under way. The data so far secured are far from complete but suffice for the making of usable tentative management plans for large national forest areas to be managed on a sustained yield basis.

e. Root Studies. Very little is known about the roots of forest trees, either here or elsewhere, primarily because of technical difficulties involved in the excavation of large root systems intact. This is practically a virgin field for original research. Silviculture is very largely based on behavior of the visible portions of the tree or crown; that the root system is of equally importance is rapidly coming to be recognized. In Europe the subject of tree roots has been one of active interest lately, but the work has largely been confined to seedlings. In this country extensive work has been done on herbaceous species, but little on shrubs and trees. Practically nothing has been done on large trees under natural conditions.

By the use of high pressure streams from water pumps developed for fire control, excavating large roots becomes reasonably easy. With such equipment, a study of the roots of a 53-year old western yellow pine stand was started last year. A number of important facts have already been disclosed, dealing with the relation of crown and roots, the position of feeding rootlets and the development of dual root systems, all of which may be extremely helpful in solving many of the complex silvicultural problems of the pine region.

2. Forest Influence Studies.

The part that forests play in the production of cellulose, either in wood or forage, will continue to be important in the economic development of the State, even if the per capita consumption of wood be further diminished. Forests, however, also play an important role in their effect on runoff and the stabilization of our water-supply and their prevention of abnormal and detrimental erosion. These problems have been grouped under the heading of forest influence studies. In localities of this State where precipitation is small in amount but torrential in character, where agriculture is dependent upon the maximum conservation of rainfall, and where erosion may assume disastrous proportions because of steep slopes, the demand for forest influence studies

is becoming most insistent. For these reasons the first intensive forest influence study undertaken in California has been started in southern California at Devil Canyon, San Bernardino County. At the present stage we are principally concerned in the development of a technique in the measurement of run-off and erosion. Very little has been done previously in satisfactorily measuring torrential runoff charged with heavy burdens of eroded material. A 60-acre area at Devil Canyon which was completely denuded by fire in 1925 was selected for this study. A dirt dam and a holding basin have been constructed and equipment has been installed to measure intensity of rainfall, amount and rate of run-off, and the quantity of material eroded. Permanent check plots are under observation to see how Nature attempts to recapture and fix the soil by vegetative growth. In addition to this large scale study, smaller plots have been selected for detailed study where the original cover has been left intact, and similar ones which have been burned. So far, most striking results as to the effect of cover on superficial run-off have been brought out. Further laboratory studies of this phase of the problem are being carried on in cooperation with the Forestry Division of the University of California. Soils of different origin, with varying degrees of humus content have been transported to special plots, where natural and artificial precipitation have

been applied, giving measurements of superficial run-off, seepage and eroded material. One interesting phase of this study is the light, of which there now seems to be promise, upon the mooted question of the influence of forests upon climate and the mechanics by which that influence is exerted.

3. Products and Utilization

The Office of Forest Products has only been recently transferred to the Station from the Administrative organization. This affords an opportunity of closer coordination in two important fields of work, - silviculture and products. The chief function of this new section of the Station is to conduct studies in the conservation of wood products through the elimination of waste in manufacture and use. It is interested in conversion waste, from the felling of the timber onward, and in logging and sawmill practice as affecting both waste and the better adaptation of major products to consumer requirements, in wood uses, wood preservation, utilization of inferior species or material now unmarketable, and in pulp and paper and every important forest by-product. In the field of economics, this Section gathers important statistics on lumber production and lumber and stumpage prices, in cooperation with the Census Bureau on the major uses of wood and on lumber markets and distribution, and other problems. While much of the products research of the Forest Service is centralized at the Madison Forest Products Laboratory,

particularly that requiring specialized laboratory equipment, or involving nation-wide attack, the Experiment Station, through its Products Section, has a special field in local problems and, for its region, in those which must be studied on the ground, or in place. It also coordinates its work with that of the central laboratory, acts as an extension arm for its technical results, and assist it in nation-wide projects.

The scheduled projects of the past year for this Section included the following studies:

a. Marine Pile Borers. In cooperation with many other agencies, through the San Francisco Bay Marine Piling Committee, a survey of the damages due to marine borers, with intensive biological, chemical, and engineering study of their life history, and appropriate methods for control, were completed after six years work. Of this work our Products representative bore the major administrative burden, as Executive Officer of the Committee. The results of this extensive study have been published in an exhaustive report.

b. Termites. Increasing termite infestation in buildings, especially in southern California, called for special study. In cooperation with Dr. T. E. Snyder of the Bureau of Entomology, protective measures against this pest were formulated and their insertion secured in the uniform building code for the Pacific Coast.

c. Lumber Seasoning. Under this project some work was done on air seasoning, of which a preceding three years' detailed study resulted in large benefit to the lumber industry; also on lumber depreciation, and prevention of blue stain.

d. Studies in Utilization. Considerable time was given to the study of white fir, one of the important inferior species. The lumber from this tree has slowly won its way in eastern markets, but ruinous competition of the Douglas fir from the Northwest has seriously hampered a steady market at remunerative prices, as have some current practices of our own lumber industry. If white fir could be logged and the lumber sold at a reasonable profit, the handling of our mixed conifer type land with better silvicultural practice would be greatly simplified for both Government and private forestry.

e. Forest By-Products. Heptane, distilled from oleoresin of the Jeffrey pine, is now being used as a reagent in determining the knock of gasoline, as the basis for dosage with tetra-ethyl-lead. This is yet in an experimental stage. In cooperation with a commercial tapping operation on Jeffrey pine, an experimental study was carried on on the Lassen National Forest. This experiment was to furnish data as to yields, cost, best tapping practice, and effects on the ultimate timber product of the trees tapped. Tapping for turpentine in the southern pine region has given an increased value to the forests

of the South. If heptane develops a real commercial outlet, we may expect an appreciable increase in value in our extensive Jeffrey pine timber holdings.

f. Economic Investigations. The more important studies here were conducting the lumber census for the Bureau of the Census, and obtaining data on stumpage prices by questionaire and cooperation with the lumber industry.

Many other problems of the economics of marketing and use, as well as of conversion waste, should be undertaken by the Products Section, and wait only on sufficient personnel and resources for their conduct.

4. Protection Studies - Fire.

The forests in this State can only be maintained at maximum productive capacity by reducing fire damage to a minimum. The value of watersheds can only be insured by maintaining a complete vegetative cover.

a. Damage Studies. Past fire studies have been largely confined to the measurement of damage to the forest crop. A series of plots representing different tree species which were burned over have been followed for a number of years to study the effects of fires on merchantable timber and young growth. In the California National Forest a controlled fire was set in 1920 to determine the vegetative changes after burning in the borderland between brushfields and timber. The evidence is that timber under

these conditions is being pushed back and that brushfields are steadily invading timbered areas. This experimental plot will be followed and reburned every five years. This destructive process has been repeating itself over a great part of our foothill areas, and extensive investigations show that the timber belt has been crowded back from 6-20 miles all along the whole Sierra front.

b. Light Burning Studies. Light burning, a subject which has been widely discussed pro and con in the last two decades, has been carefully studied on a number of areas. One permanent 200-acre plot, on the Plumas National Forest, in virgin timber, has been under observation since 1919. A burn was attempted every year during the life of the experiment, only four being even partially successful. This experiment was intended to determine the protective value of annual light burning against summer fires, the feasibility of such controlled burning, the damage resulting, and the effects on insect infestations. The results prove conclusively that it is impossible to light-burn annually any large area at a safe period. Where fire burns only the forest litter, the inevitable complete destruction of new seedlings and damage to the older reproduction may be expected. The last burning, in 1927, continued definitely to reduce the stand by the undercutting of scarred trees to almost the same degree as in the first

light-burning. The losses due to bark beetle attacks following each fire have increased above normal endemic infestations in the surrounding territory. The results of these fire damage and light burning studies have already been incorporated in two publications.

c. Statistical Studies. The history of individual fires handled by the National Forest administration has been recorded with reasonable accuracy since 1911. The complete story from the start of each fire to its complete extinction is available for 14,000 fires. Of these a detailed statistical analysis covering the period 1911-1920 has already been published. The fires from 1921-1926, handled by the National Forest administration, are now being subjected to a similar analysis. These statistical fire studies have been most helpful in the determination of fire hazards and risks, adequacy of fire fighting organizations, efficiency of methods of control, and other pertinent facts about the problem. The continuance of these studies promises further significant data, just as the statistical treatment of mass data has been of value in other fields of agriculture, economics, and education.

d. Fire Weather Forecasting. "Unusual weather" is no mere catch-phrase in California. Floods and drought are infrequent but not unusual. The vagaries of our climate has an important bearing on the character of our fire season. Periods of severe drought increase

enormously the likelihood of fires starting and the rate and severity of their spread. It is important to know accurately when to expect seasons or periods of drought, high drying winds, and fire-setting lightning storms. In cooperation with the United States Weather Bureau a series of meteorological studies have been undertaken throughout our forested areas, so that adequate forecasting can be developed. This is of vital importance to all forest protective agencies.

Protection - Insects.

The United States Bureau of Entomology has assigned one investigator to our staff, in charge of entomological investigations. The major problem under consideration deals with the life habits and control of the western pine bark beetle, the most destructive single pest menacing our western yellow pine forests. In parts of this State annual losses from this beetle to mature timber have assumed alarming proportions. Holders of stumpage in Modoc and Siskiyou counties are confronted with an annual loss of 10 per cent of their mature timber unless the epidemic abates. Control work by cutting down infested trees and burning the larvae is only partially successful. More must be known about the life habits of this beetle, its predatious natural enemies, susceptibility of trees, effects of cutting, slash disposal and fire before effective measures of control can be devised. Recent studies indicate that fires running over areas tend to intensify insect attacks. Losses from insects to fire

injured trees may be greater than the direct loss from the fire itself. Under certain critical conditions insect damage to stands reserved after cutting may exceed the annual increment. A study of susceptible types of trees indicates the possibility of avoiding insect loss in sale areas by carefully regulated selective cutting. Slowing up of growth generally makes a tree more susceptible to attack. Drought is an important factor in producing epidemics and accounts, in part, for the present serious losses in the northeastern part of the State. The urgent need for increased work in this field becomes apparent as successive epidemics sweep the state.

5. Economic Studies.

Only one study has been handled in the past year in this field. A cover type map of the entire State exclusive of agricultural land is now about half completed. This map will delineate the various types of chaparral and brushfields and the different types of timber stands. In the consideration of any State-wide plan of land use these data will have fundamental importance.

6., Reforestation.

Experimental nursery and planting work in the California pine region was carried on a number of years ago; the results are now ready for publication. For this region natural regeneration is unquestionably the safest and surest way of perpetuating our forests. Planting

need only be resorted to on lands completely denuded by fire, destructive logging or over-grazing. Reforestation will play a more important part as intensive forestry practice is applied and the loss from an unproductive waiting interval becomes a more important economic consideration. In order to be ready to meet this future demand with adequate information, a series of planting experiments are again under way at the Feather River sub-station on the Plumas National Forest.

There has been an insistent popular demand for converting the southern California brushfields into high coniferous forests by extensive planting operations. The Forest Service, years ago, carried on such work experimentally, the conclusion being that only under the most favorable conditions could successful plantations be established. Prohibitive costs of artificial forestation exclude the practicability of raising forests on these brush areas for commercial exploitation. However, this should not preclude the conversion of brushfields into high coniferous forests in restricted favorable areas, for recreational and aesthetic values, where the public is willing to pay the bill. It is yet to be determined whether a high coniferous forest will have greater watershed protective value than brushfields and woodland in this region.

Plans for the immediate future.

This survey of our activities indicates some phases of our work to which attention should here be directed.

Some of the newer problems which now confront us seem to be of more significance than some of those undertaken in the past. On the other hand most of the projects which have been under way for a number of years require further work in order to realize the benefits of the expenditures already invested. With Federal and cooperative appropriations held at the same level, no further extension of the program seems advisable. Until increased resources are available certain minor shifts in projects are all that is possible and some such shifts may be profitable.

In a general way it may be well to consider some of the more conspicuous problems of real merit and importance that are now inadequately provided for or entirely omitted. The Experiment Station is doing no work in the Redwood Region, nor in the Central Coast Range. Watershed problems in the Sierras have scarcely been touched. Grazing, an important industry which frequently conflicts with other major uses of our forest lands, is not included among our activities. In the economic field, much essential basic material must be gathered before a sound State forest policy can be formulated.

With the completion of our cover type map the next logical step is the building up of accurate stand and site maps for all the timber bearing lands of the State. Present estimates of our timber resources are inaccurate and misleading. The building up of a more accurate and adequate body of data for the whole State can be accomplished only with the help of the private timber land owners of the State. These lines of work should ultimately lead to one of the most essential prerequisites of a sound forest policy, a forest land classification of the State. Other parts of our major economic study can naturally follow when increased funds become available.

Studies in forest influences must ultimately cover the important regions of the State. Such studies, however, are peculiarly complex and exacting and it would be dangerous to proceed hastily and superficially. The new work now proposed is only an enlargement of the work in southern California, where four similar canyons, two denuded by fire and two left intact will be studied for effects of cover on run-off and erosion.

An urgent problem of vital concern to lumbermen and foresters alike is to make industrial forestry an actuality in the forests of California. In a broad way, the national forests of the State are under a system of forest management, insuring continuous crop production.

The Redwood Industry has made an excellent start in this direction and, as time goes on, the pine industry may be expected to follow. In fact certain desirable and important practices as for example, cutting low stumps, intensive utilization and above all intensive systematic fire protection have been widely adopted. The Experiment Station has a distinct obligation to be prepared with the essential facts which will stimulate and accelerate this movement. The results of experiments on national forest lands are already available to the industry, and are in large measure applicable to their problem, but very much remains to be done.

There are problems peculiar to the lumber industry, which will require special consideration. One project of this character was proposed for this summer. It involved a study of cutting methods now in use on private holdings, yields that are possible under such systems of lumbering, the costs of logging and milling trees of varying sizes in different types of forest, the quantity and quality of lumber produced, the waste involved and the possibilities of their reduction. Such a study would show what trees and what stands can be cut at a profit. Similar studies have in part been conducted on Government timber sales in California. A complete analysis is

impossible without active and financial cooperation of some operator, especially in the manufacturing phases. In the Lake States one of these studies, by showing the unprofitableness of logging small material, was most valuable to the industry and gave a real impetus to industrial forestry. As a consequence a system of selective logging in hardwood forests is being put into extensive practice in that region. Whether such a comprehensive study can be initiated here will depend upon an appreciation of its value such as to lead to adequate cooperation on the part of some large California operator.

FINANCIAL STATEMENT

(Fiscal Year - 1928)

Income

Federal Appropriations	43,100.00	
State Appropriations	7,500.00	
Southern California Agencies	7,700.00	58,300.00

Distribution of Expenditures

Salaries Technical Staff	33,300.00	
Salaries Clerical	6,600.00	
Travel Expenditures	8,650.00	
Labor, field assistants)		
laboratory ")	3,600.00	
Equipment, Supplies, Instruments Telephone, Telegraph, Structures, etc.	6,150.00	58,300.00

DISTRIBUTION OF EXPENDITURES BY PROJECTS

	Northern California	Southern California	Total
Forestation	1,500.00	7,380.00	8,880.00
Fire	3,500.00	500.00	4,000.00
Economics - Cover Type Map	4,100.00	6,000.00	10,100.00
Forest Influence	-	10,500.00	10,500.00
Management Studies Pine Region	12,600.00	-	12,600.00
Products and Utilization	8,460.00	500.00	8,960.00
Special Studies	3,260.00	-	3,260.00
TOTAL	33,420.00	24,880.00	58,300.00

S T A T I S T I C S

APPROXIMATE TIMBER AND LAND STATISTICS FOR CALIFORNIA

I.

VIRGIN TIMBER STAND AND AREA, AND AREAS OF CUT-OVER, BURNED AND BRUSH LANDS
April,1928

Ownership	Virgin Timber: Stand M.ft.B.M.	Virgin Timber: Area Acres	Cut-over, burned and brush: Area - Acres: Restocking	Cut-over, burned and brush: Area - Acres: Not restocking	Total area commercial forest land. Virgin, second growth & treeless. Acres
Pine Region (Private	92,910,000	3,097,000	1,200,000	690,000	4,987,000
Pine Region (State	230,000	50,000	-	-	50,000
Pine Region (Federal	93,000,000	8,500,000	1,315,000	564,000	10,379,000
Pine Region (TOTAL	186,140,000	11,647,000	2,515,000	1,254,000	15,416,000
			3,769,000		
Redwood Region (Private	73,675,000	1,019,000	611,000	165,000	1,795,000
State Total	259,815,000	12,666,000	3,126,000	1,419,000	17,211,000
			4,545,000		

NOTE: The figures above were derived by comparing the data from four sources, viz, "Forest Figures for the Pacific Coast States"; "Timber Crop Report" of 1922 by Show and Dunning; "Report to the Legislature on Senate Concurrent Resolution No. 27", by E. N. Munns; "Estimate of Green Timber on National Forests, District 5", dated March 9, 1926. The unreliability of our present information on California's timber resources is well illustrated by the differences between these various compilations.

Very rough adjustments were made to eliminate non-commercial areas, so that the figures in this table represent land and timber which can supposedly be reached fairly readily by present methods of logging. Perhaps one third or more of the total virgin timber area should not be considered as economically exploitable until lumber prices rise considerably above their present level. Second growth on cut-over areas is not included in this compilation.

II.

ANNUAL LUMBER CUT
(Average, last 3 years)

Ownership	Amount-Million ft.B.M.			Area - Acres		
	Pine Region	Redwood Region	State Total	Pine Region	Redwood Region	State Total
Government	290	-	290	14,000	-	14,000
Private	1,210	605	1,815	46,000	10,000	56,000
TOTAL	1,500	605	2,105	60,000	10,000	70,000

NOTE: Present annual cut of 2,105 million feet may possibly increase to 3 billion feet yearly by the end of the next 6-10 yr. period but it seems rather doubtful that it will ever exceed 3 billion.

III.

LUMBER INDUSTRY
(1925 census report)

	Sawmills only	Planing mills not operated by sawmills	Box factories	Totals
Value of Products	$73,000,000	$104,600,000	$10,500,000	$188,100,000
Number employed	26,500	9,200	1,770	37,470
Salaries & wages	$38,700,000	$ 17,290,000	$ 2,410,000	$58,400,000

Estimated capital invested in sawmills and their auxiliary plants, logging railroads, machinery and camps - $60,000,000.

Value of remaining commercial virgin stumpage in California -

at $2.00 per M. - $ 519,630,000
" $3.00 " " - $ 779,445,000

IV.

GRAZING
(from article by Show in California Countryman)

Grazing lands in National Forests - 11,000,000 acres
used by - 200,000 cattle & horses
and - 500,000 sheep & goats

V.

AGRICULTURE

Total all classes agricultural land ---------- 24,000,000 acres
Agricultural land now improved---------- 12,000,000 "
" " under irrigation---------- 6,000,000 "
Land possible to irrigate if water resources dev.- 14,000,000+ "

+According to Frank Adams. Bailey estimated 18,000,000 acres on basis of his comprehensive plan for carrying surplus water of NW part of State to surplus lands of San Joaquin Valley.

Present value field and fruit crop, yearly -------$400,000,000

VI.

WATER RESOURCES OF STATE
(From Paul Bailey's reports)

Drainage	Average annual runoff: Acre-feet	Maximum available for irrigation. Acre-feet
Sacramento Basin	25,199,500	20,263,640
San Joaquin "	12,331,300	9,573,090
San Francisco "	825,300	595,320
North Pacific "	26,835,100	22,624,740
South Pacific "	3,441,800	2,282,180
Great Basin	3,898,350	2,921,420
State Total	72,531,350	58,260,390

In his comprehensive Plan for making maximum use of the State's waters for irrigation purposes, Bailey points out that the combined maximum water yield is 2-3/4 times the average runoff and the minimum yield in dry seasons is but 3/8 as much as the average. Storage facilities to equalize completely streamflow and care for maximum floods must have a capacity 3.17 times the net maximum available for irrigation. In round figures, reservoir capacity would have to provide for the storage of 184,907,210 acre feet. Disregarding maximum flood control, but providing simply enough storage to irrigate all of the state's irrigable lands will require 50,000,000 acre feet capacity. The cost of storage works would be 1-1/4 billion dollars.

(Note by M.R.B.) With 1-1/4 billions invested in dams and distributing ditches it ought to be pretty good business to insure against silting by investing part of the total in maintaining forest and other vegetative cover on all watersheds.

VII.

DISTRIBUTION OF IRRIGABLE LANDS

To show the distribution by regions of California's irrigable lands, the following table divides the State into six major agricultural areas. Bailey claims 18,000,000 acres can be irrigated but Frank Adams says 14,000,000 is probably the maximum. Bailey's figures for irrigable area have therefore been adjusted to avoid possible exaggeration. Note the importance of the National Forests as watersheds for 7/8 of the Great Central Valley lands (1), also the brush forests for (2), (3) and (4).

Drainage Basins	Acres now irrigated	Total irrigable Area. Acres
San Francisco Bay - From Pit River in extreme northeast to Kern: Sacramento and San Joaquin Rivers - Great Central Valley. 7/8 of all waters drain from Sierra Nevada range	4,260,000	10,000,000
Pacific Coast - San Francisco to Santa Barbara channel	135,000	800,000
Pacific Coast - Santa Barbara channel to Mexican border	759,000	1,500,000
Great Basin - South of Lake Tahoe	500,000	1,200,000
Great Basin - North of Lake Tahoe	82,500	130,500
North Pacific Coast	87,300	600,000
TOTAL	5,823,800	14,230,500

STATEMENT OF S. B. SHOW, DISTRICT FORESTER, CALIFORNIA DISTRICT BEFORE THE ADVISORY COUNCIL OF THE CALIFORNIA FOREST EXPERIMENT STATION, APRIL 16, 1928.

Obviously, it seems to me, a program of forest research must be based on a reasonably accurate and balanced knowledge of the actual forest problems of the region if it is to be of actual service in advancing the practise of forestry and avoid the pitfalls of futility which await the scientific worker who loses sight of the use of his results. For so-called pure or fundamental research we can all have respect and at the same time recognize that at the present time forestry in California is in the pioneering stages, and requires, in the main, the type of research commonly called applied research.

The word forestry does not in fact give a picture of the California problem. It is more accurate to say that the proper use and management of wild lands is the goal. We have large areas of such wild land with a primary value for the production of commercial forests; other very large areas on which the production of forage will make the greatest economic return; others where protection of water supplies through maintenance of a vegetative cover in all important; still others where the dominant purpose should be protection of game. A well-rounded use of our wild lands must also include the reservation of certain areas where recreation is the sole or principal purpose, but it would be a serious mistake to consider the forest problem primarily one of aesthetics. It is basically a

problem of economic use of wild lands.

The common denominator in any consideration of California's wild lands is the ever-present and ever-critical fire problem. Regardless of ownership, and regardless of the purpose or purposes of land management, solution of this problem is urgent. Forest fires cannot be stopped by research but knowledge of their occurrence, causes, behavior, methodsof control, and their relation to weather conditions can be enormously valuable in combatting them. This field then, is one which I believe should be strongly represented on the experiment station program.

The production of crops such as trees and forage give rise to a host of purely technical problems, complicated in the case of timber growing by the period of 60 to 120 years required for the crop to mature. In the pine region, with an area of some 14 million acres now in forest, information is needed on the rate of growth following different methods of cutting, the relative damage caused by various logging methods, the yield of second growth forests, how to reproduce different species under a host of variable conditions, the degree to which grazing of livestock may be harmonized with timber production and ammultitude of other technical questions. It is not enough for the research man to determine that a certain practice will give certain results. He must also find out what the practice will cost in comparison with other methods, and what the returns will be. Particularly for the private owner of forest lands, who is struggling with the business problem of making a profit from his operations, and only slightly less so for the public owner, a rapid solution of the questions mentioned, and their cost and returns,

is highly important.

Likewise in the use of land for grazing, we have to deal with hundreds of plant species, concerning which relatively little is known. A great deal of information is needed regarding the plants themselves, as well as the manner and closeness of grazing, the kind of livestock to use, the period of use, etc., which will maintain or improve the range and give the greatest return. At least for public lands, each use must be managed not only as an end in itself, but in relation to other uses. For example, the harvesting of timber must be so handled as to leave the value of the land for water conservation substantially unimpaired, and where grazing is allowed on timber lands it must not unduly injure the forest crop. A study of these complicated inter-relationships is most important, for in actual practice two or more uses are practicable and desirable on the same area.

On many producing timber lands and of obvious primary value for that purpose, there is also grazing of domestic livestock, grazing of game animals, use of the land for several sorts of recreation, and use for water conservation. It would vastly simplify land management to segregate these uses, and put each on a land area of its own, and to a certain extent this must probably be done, but such a course of action would greatly reduce the total out-put of benefits on the wild lands of the State.

Just how far the experiment station can and should go into this complex field of forest economics is in my opinion a question. Certainly coordinated land use ranks with fire control, timber and forage production, water conservation as a major aspect

of the forest problem in California. Extreme points of view regarding wild land use are common, and usually demand the exclusive dedication to a single purpose.

Land management, regardless of ownership, which ignores the very great watershed value of mountain lands is headed for trouble. But information is very scanty regarding the specific results on specific soils for logging, fire, grazing and other factors which disturb to a greater or lesser degree the natural cover. The experiment station has an exceedingly important function to replace our general knowledge and opinion with more detailed facts, and should I believe carry in its program a good deal of work on forest influences.

Above everything else, the outstanding consideration is to keep these wild lands producing, and where now unproductive, to change that condition. Idle land is a liability and certainly the State will require that all of its land be kept at work. Loss and decrease of productivity have been and are due to two main things; fire, and the logging of private lands without provision for a new timber crop. It is easy and not altogether just to simply state this fact without recognizing that private ownership is necessarily conservative and requires facts and information before embarking on long-term enterprises. To the extent that basic data on cost and returns of timber growing are lacking the station should aim to supply them as rapidly as possible.

If it is in the public interest that private lands be managed not only to produce a revenue to the owners, but also to stabilize water production for the benefit of those making no contribution to the cost of protecting and managing the lands, then clearly

the public has an obligation on its part. Probably the field of forest politics is one which for the present the Station should avoid, but in a practical world, a great service could be rendered by investigations in this troubled subject.

MINUTES OF FIRST MEETING OF ADVISORY COUNCIL CALIFORNIA FOREST EXPERIMENT STATION April 16, 1928

The meeting was called to order by Director E. I. Kotok, of the Experiment Station, at 10:00 A.M., in the Board room of the California Development Association, Ferry Building, San Francisco.

Present

Swift Berry
Dr. E. E. Brownell
Francis Cuttle
Chas. G. Dunwoody
F. H. Fowler
Herbert S. Gilman
Professor Walter Mulford
W. B. Rider, representing M. B. Pratt
R. G. Sproul, representing President W. W. Campbell
D. H. Steinmetz
Dr. Ray Lyman Wilbur
S. B. Show

The Council was welcomed by Norman H. Sloane, General Manager of the California Development Association, in a short address which emphasized the importance attached by the Association to the establishment of the Forest Experiment Station in California, especially because of the direct relation of forests to the all-important factor for California - the conservation of water resources. He congratulated the Station and the State on the personnel of the Advisory Council, which can do much to contribute a sound forestry program.

Director Kotok on calling the meeting to order asked Professor Walter Mulford to act as temporary chairman.

To supply the background of forest research development and give the setting of the picture for the consideration by the Council of the work of the Station as now in progress and its program for the future, Mr. S. B. Show, District Forester for the California District of the Forest Service, read a paper on "Some Problems in Forestry". In connection with the discussion of Mr. Show's paper, it was unanimously agreed to make the sessions of the Council as informal as possible.

Mr. Kotok followed with a statement of the organization, present work and future plans of the Station, copies of which have been supplied to each member of the Council. Some statistical data respecting forestry in California, gathered from diverse sources, but the best available, were also furnished. These data are incomplete and conflicting and point to the need for a comprehensive survey of the timber stands

in the State. Among the points brought out by the very full discussion which the statement called forth were the following:

The desirability of balance in a research program between projects upon which results can be rapidly reached, those of longer continuance but of which partial results can from time to time be made available as progress reports, and those long time projects which by their nature must await complete solution before any results can be stated. The Council realized the importance of fundamental research but felt that there is much desirability in maintaining a sufficient proportion of the shorter kind of projects to permit relatively frequent feeding out of results, so as to sustain a keen public understanding and interest. Mr. Kotok stated that the studies now in progress, which were mostly inherited by the Station, are for the larger proportion long time studies; but that he estimated nearly three-fourths of even these long time studies to be of such a nature as to permit frequent progress reports.

As an illustration he cited the project which the Forest Service here has been accustomed to call the Economic Study, as distinguished from the general body of economic studies in the field of forestry. This study aims to picture the probable demands for goods and service from the forests of California 50 years hence. This forecast is to be based on the expected distribution of population, industries and other human uses in correlation with present and future location of forests, commercial or otherwise. It demands a complete land use classification, which also is the basis for a sound forest policy.

The cover type map of California, now being completed by the Station, is one phase of the major Economic Study and should be released and published on completion as a separate entity, for practical use by different agencies.

There was considerable discussion of the forest influence studies of the Station. It was agreed that the striking preliminary results in respect to erosion from burned as against unburned areas, showing from 75 to 100 times as much sediment carried from the former as from the latter are most significant; however, they should not be broadcast as representing natural conditions, where so many uncontrolled factors may change the net results in a specific case. They are to be regarded rather as confidential figures at present, to be used most carefully until their relation to natural conditions has been more fully established.

The present program of the Station, as presented by Mr. Kotok, was tentatively approved, on the understanding

that as funds increase the work of the Station will be increased in the directions where it is known to be inadequate. The most important points for this expansion to be applied were agreed to be, in the order of importance:

1. (The Economic study
   (Forest influences
   (Fire studies

2. Undertaking of research in the redwood region

3. Grazing studies

The Council then elected the following officers:

President	-	Dr. Ray Lyman Wilbur
Vice-President	-	Professor Walter Mulford
Secretary	-	Director E. I. Kotok

Mr. Mulford then relinguished the chair to Dr. Wilbur. There followed a discussion of the functions of the Council, the objectives set up being as follows:

1. To advise the Forester and the Secretary of Agriculture in respect to forest research work in the California region, particularly as affecting the California Station.

2. To stimulate a close correlation of research work between the Station and other agencies in this region.

3. To assist the Station in public education and the dissemination of the Station's research results.

In respect to the latter point, it was moved by Mr. Cuttle and seconded by Mr. Fowler that a publicity committee be appointed by the President to give out approved information and to create a public interest in forest research. The Director was requested to transmit to the Council members from time to time progress results or other pertinent information. Motion passed.

It was moved by Mr. Dunwoody and seconded by Mr. Gilman that the Experiment Station undertake a project under its economic studies, when funds are available, which will eventually lead to the classification of California's forest lands, and that this information be gathered by regions rather than for the State as a whole. After discussion the motion was carried unanimously.

The Council then turned to a consideration of the finances of the Station. After discussion of the inadequacy of present resources, it was moved by Mr. Cuttle that the

State be urged to include not less than its present appropriations in any future budget for the support of the work of the Experiment Station. Motion passed.

President Wilbur then suggested that it would doubtless prove helpful to pass a motion welcoming general financial cooperation, so that it could be brought to the attention of counties or other communities and of individuals. Such a motion was made by Mr. Gilman, seconded by Mr. Fowler and unanimously passed.

Consideration of finances led to a discussion of the McNary-McSweeney Bill, in respect to which a statement was made by Mr. Dunwoody. This discussion resulted in agreement that action as a body by resolution would be less effective than by the individual members. Some of the members also favored this method because of lack of opportunity for a more detailed study of this measure. It was requested that a copy of the Bill and any pertinent summaries of or statements respecting it be sent to each member of the Council, with the understanding that the members would take prompt action by wire through the California Congressional delegation.

It was moved by Mr. Cuttle that the calling of the next meeting be left to the discretion of the President, Vice-President and Secretary. Seconded and carried.

Meeting adjourned at 12:10 P.M.

E. I. KOTOK
Secretary

MEMBERS OF THE [redacted]SORY COUNCIL

OF THE CALIFORNIA FOR[redacted] EXPERIMENT STATION

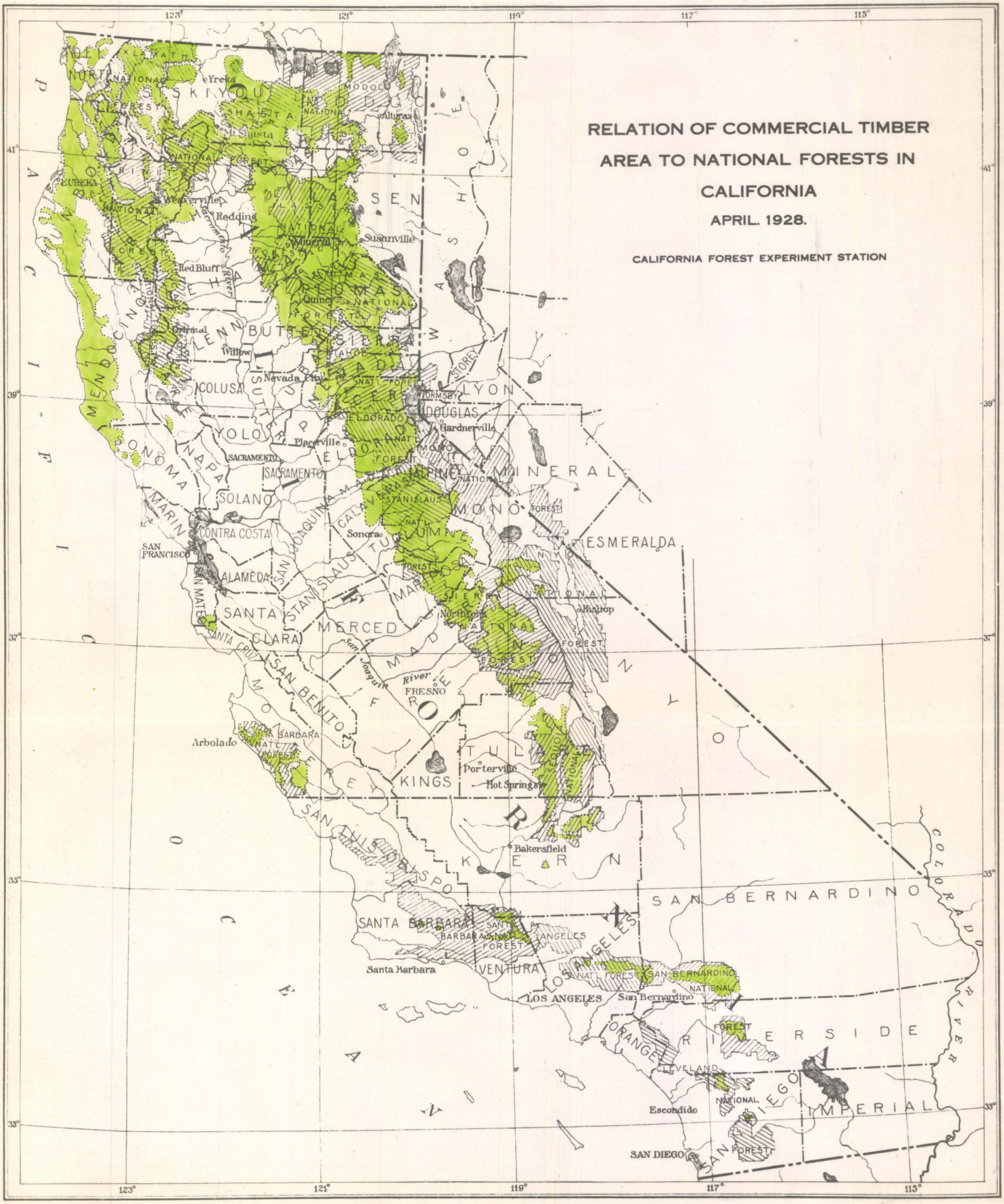
Swift Berry	Michigan-California Lumber Co., Camino, Cal. Forester, Michigan-California Lumber Co.
Dr. E. E. Brownell	3696 Clay St., San Francisco Director, Calif. Wool Grower's Assn.
Dr. W. W. Campbell	University of California, Berkeley President, University of California
Francis Cuttle	Riverside, California Vice-Pres. Conservation Assn. Southern California; Chairman, Tri-Counties Forestry Assn. Member, State Board of Forestry
Chas. G. Dunwoody	California Development Assn., Ferry Bldg., San Francisco Director, Conservation Dept., California Development Assn.
F. H. Fowler	First National Bank Building, San Francisco Hydro-Electric Engineer
Herbert S. Gilman	San Dimas, California President, Angeles Forest Protective Assn. Director, Conservation Assn. of Southern California.
A. C. Hardison	Santa Paula, California Member of Executive Committee American Farm Bureau Federation; Director, Calif. Development Assn. " Conservation Assn. of Southern California.
C. R. Johnson	Union Lumber Co., 1010 Crocker Bldg., S.F. President Union Lumber Co., Director, Calif. Redwood Assn.
B. A. McAllister	65 Market St., San Francisco Vice-President, Albion Lumber Company Land Commissioner, So. Pac. Ry. Co.
Duncan McDuffie	210 Post St., San Francisco Chairman, State Parks Council; Councillor, Save the Redwoods League.
Prof. Walter Mulford	305 Hilgard Hall, University of California Berkeley, California. Chief, Division of Forestry, University of California Chairman, Forestry Study Committee, Calif. Development Assn.

Prof. Walter Mulford	305 Hilgard Hall, University of California Berkeley, California Chief, Division of Forestry, University of California Chairman, Forestry Study Committee, Calif. Development Assn.
Edward W. Murphy	247 South Central Avenue, Los Angeles Chairman, State-wide Conservation Committee Director, California Development Assn.
A. Stanwood Murphy	Pacific Lumber Co., Scotia, Calif. Executive Vice-President, Pacific Lumber Co. Director, Calif. Redwood Assn.
M. B. Pratt	Forum Building, Sacramento, Calif. State Forester
H. M. Robinson	707 South Spring St., Los Angeles, Calif. President, Los Angeles-First National Trust & Savings Bank, Los Angeles
D. H. Steinmetz	Pickering Lumber Co., Standard, Calif. Vice-Pres. and Gen'l. Mgr. Pickering Lumber Company; Pres. Calif. White & Sugar Pine Mfrs. Assn.
Spence D. Turner	202 N. Broadway, Los Angeles, Calif. County Forester, Los Angeles County
Willis J. Walker	307 Monadnock Building, San Francisco Vice-President, Red River Lbr. Co., Director, Calif. White & Sugar Pine Mfrs. Assn.
Dr. Ray Lyman Wilbur	Stanford University, Palo Alto, Calif. President, Leland Stanford University
I. Zellerbach	534 Battery St., San Francisco President, Zellerbach Paper Co., " State Fish & Game Commission
S. B. Show	Forest Service, Ferry Bldg., San Francisco District Forester, California District. Ex-officio member, representing National Forest Administration.
E. I. Kotok	113 Hilgard Hall, University of California Berkeley, California Director, California Forest Experiment Station.

RELATION OF COMMERCIAL TIMBER AREA TO NATIONAL FORESTS IN CALIFORNIA

APRIL. 1928.

CALIFORNIA FOREST EXPERIMENT STATION



FOREST
CALIFORNIA/EXPERIMENT STATION

BRANCH STATIONS AND SAMPLE PLOTS
ESTABLISHED
TO
APRIL, 1928.

LEGEND

- CALIFORNIA FOREST EXPERIMENT STATION, BERKELEY
- BRANCH STATIONS
  - ① FEATHER RIVER
  - ② STANISLAUS CENTER
  - ③ DEVIL CANYON
  - ④ MT. SHASTA
- ▲ SAMPLE PLOTS

OREGON
Cresent City
KLAMATH NAT'L FOREST
Yreka
MODOC NATIONAL FOREST
SHASTA
Mt. Shasta
NAT'L FOREST
Alturas
TRINITY
Eureka
NAT'L FOREST
Weaverville
Redding
LASSEN NAT'L FOREST
LASSEN NAT'L PARK
Susanville
N.F.
Red Bluff
PLUMAS N.F.
Quincy
CALIFORNIA N.F.
Willows
TAHOE NAT'L FOREST
Nevada City
Ukiah
Minden
ELDORADO N.F.
Placerville
SACRAMENTO
MONO NATIONAL FOREST
STANISLAUS N.F.
Stockton
Sonora
Berkeley
San Francisco
YOSEMITE NAT'L PARK
INYO
SIERRA NATIONAL FOREST
Bishop
NAT'L FOREST
North Fork
Santa Cruz
Fresno
GEN. GRANT NAT'L PARK
SEQUOIA NAT'L PARK
SEQUOIA NAT'L FOREST
Monterey
SANTA BARBARA N.F.
Porterville
Bakersfield
San Luis Obispo
Mojave
Barstow
Needles
Ludlow
Cadiz
SANTA BARBARA NAT'L FOREST
ANGELES NAT'L FOREST
Santa Barbara
Ventura
SAN BERNARDINO NAT'L FOREST
San Bernardino
Los Angeles
CLEVELAND NAT'L FOREST
NATIONAL FOREST
Escondido
El Centro
San Diego
Yuma
MEXICO
PACIFIC OCEAN
NEVADA